DRAFT Multiple Discharger Variance for Mercury in the Willamette Basin

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State of Oregon
Department of
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Quality

EFORMA

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State of Oregon Department of Environmental Quality

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1. Introduction and Background

A variance is a regulatory tool under the Clean Water Act to address circumstances in which a water quality standard is not currently attainable, but it is possible to make incremental progress toward meeting the standard. A variance is a temporary designated use and criterion for a

Ex. 5 Deliberative Process (DP)

This document serves multiple purposes:

1. It supports DEQ's proposed rule amendments to the Environmental Quality Commission for adoption of the MDV and amendments to the state variance rule.
2. It serves as an explanation of the MDV and variance rule amendments to the public to support DEQ's public comment process.
3. It will serve as the justification for the MDV and rule amendments for EPA approval under the Clean Water Act.
4. It will provide information to the public and the regulated community regarding how DEQ plans to implement the MDV.

1.1 Mercury in the Environment

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Mercury is a naturally occurring element found in cinnabar deposits and areas of geothermal activity. In Oregon, mercury was mined commercially and used extensively in gold and silver amalgamation (Brooks, 1971; Park and Curtis, 1997). Mercury has been used historically in fungicide formulations and can still be found in many commercial products including fluorescent lights, thermometers, thermostats, automobile switches and dental amalgam. Mercury is also naturally present in vegetation and fossil fuels such as coal, natural gas, diesel fuel and heating oil. The mercury present in these fuel sources is released into the atmosphere upon combustion. This atmospheric mercury can be transported great distances and is known to be deposited on the landscape via wet and dry deposition (Sweet *et al.*, 1999, 2003). Additional information on atmospheric deposition of mercury is provided in Section 3 of this document.

Mercury can be present in various physical and chemical forms in the environment (Ullrich *et al.,* 2001; USEPA, 2001b). The majority of the mercury found in the environment is an inorganic form, but it can be converted to methylmercury by certain anaerobic bacteria. Methylmercury production is affected by a host of physical and chemical factors including temperature, redox potential, dissolved oxygen levels, organic carbon, sulfate concentration and pH. Methylmercury represents the most bioaccumulative form of mercury in fish tissue and the most toxic form of mercury for human consumers (USEPA, 2001a). As a result, Oregon's human health criterion for mercury is based on a concentration of methylmercury in fish tissue.

1.2 Oregon's Mercury Water Quality Standard and its Application in the Willamette Basin

In 2011, Oregon adopted a fish tissue criterion for methylmercury based on a fish consumption rate of 175 grams/day to protect the health of high consumers of marine and freshwater fish and other seafood. The current human health criterion is 0.04 mg/kg methylmercury in the fish tissue. DEQ revised all the state's human health criteria based on the new fish consumption rate at that time. The EQC and interested stakeholders understood that meeting some of the toxics criteria based on this consumption rate might not be immediately attainable in some waters. Therefore, at

[1] [HYPERLINK "http://www.oregon.gov/deq/FilterDocs/chpt3mercury.pdf"]
[2] [HYPERLINK "https://www.epa.gov/wqc/human-health-criteria-methylmercury"]

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In 2003, Oregon adopted a fish tissue criterion for methylmercury based on a fish consumption rate of 17.5 g/day and DEQ used this criterion as the target for a mercury TMDL completed in 2006. EPA did not act on the 2003 criterion until 2010, when it disapproved the criterion. By this time, DEQ was conducting a rulemaking to update all the human health criteria based on an increased fish consumption rate of 175 grams/day. The revised methylmercury fish tissue criterion was adopted in 2011 and was approved by EPA.

The 2006 TMDL development generated a bio-accumulation factor for the Willamette River for several species of fish. The BAF is used to convert fish tissue criteria value to a water column criterion. In addition, the TMDL developed a translator to convert the dissolved methylmercury to a total mercury in water, which is the mercury parameter typically monitored and used in permit analyses. Using these procedures, the TMDL derived water column targets for total mercury in ng/L based on the BAF for the most sensitive species modelled, the Northern pikeminnow (*Ptychocheilus oregonensis*).

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1.3 Overview of variance regulations

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[3] Oregon variance regulations are available at [HYPERLINK "https://secure.sos.state.or.us/oard/displayDivisionRules.action?selectedDivision=1458"]
[4] Oregon implementation procedures for variances are available at [HYPERLINK "http://www.oregon.gov/deq/Filtered%20Library/IMDVariance.pdf"]

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Federal rules require that any limitations and requirements necessary to implement the variance be included as enforceable conditions of the NPDES permit for permittees subject to the variance. DEQ's process for permittees to apply for coverage under this variance and how it will incorporate enforceable conditions necessary to implement the variance in permits, is described in Section 4.

1.4 Overview of the Proposed Variance

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Designated Use

The current designated use in the Willamette Basin that cannot be attained as a result of mercury levels is fishing (fish consumption).

Pollutant

The pollutant associated with this variance is methylmercury. The human health criterion that cannot be attained is 0.04 mg/kg, as measured in the fish tissue in the Willamette River Basin. The water column concentration needed to attain the fish tissue criterion is 0.14 µg/L total mercury.

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[5] ~~OAR 340-041-0059(1)(b)(B)~~
[6] OAR 340-041-8033, Table 30

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2. The Need for the Variance

In order to grant a variance to a discharger, DEQ must find that it is not feasible to attain the designated use during the term of the variance because the criterion established to support the designated use is not currently attainable. Federal regulations at 40 CFR 131.14(b)(2)(i)(A) specify the factors that can be used to justify the need for a variance. DEQ is justifying the mercury MDV using Factor 3, "human-caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than leave in place." This section of the report summarizes the information that supports the need for the multiple discharger variance for mercury in the Willamette Basin. Section 2.1 details why human-caused conditions or sources of pollution prevent attainment of the use and cannot be remedied, highlighting the ongoing deposition of global airborne mercury in Oregon. Section 2.2 details why NPDES permittees cannot feasibly achieve WQBELs that would attain the methylmercury criterion during the term of the variance.

2.1 The methylmercury criterion for fish consumption is not currently attainable

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geologic sources of mercury that occur in Oregon soils and water that also cannot be controlled by NPDES dischargers or the state[7].

The information provided below demonstrates the need for the variance based on CFR 131.10(g)(3), human-caused pollution that cannot be remedied or would cause more environmental damage to correct than to leave in place. Although the designated use and associated criterion are not attainable during the term of the variance, NPDES dischargers will continue to implement mercury minimization programs that will reduce human-caused sources of mercury to achieve the greatest pollutant reductions possible. Therefore, a variance is an appropriate Clean Water Act tool for these facilities.

The following data and information support the need for the Willamette Basin mercury variance by demonstrating that the mercury criterion is not attainable during the term of the variance in the waterbody. Even without the mercury load coming from individual point sources in the Willamette, the mercury criterion is not attainable in the waterbody during the term of the variance due to sources of mercury outside the control of the dischargers that cannot be remedied during the term of the variance. Individual point source contributions of mercury will be reduced to the maximum extent feasible through implementation of mercury minimization plans, as described in this document.

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discharger or the state during the term of the variance.

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[7] Oregon Department of Environmental Quality, 2019. Draft Total Maximum Daily Load for Mercury in the Willamette River Basin.

[8] DEQ August, 2017. Statewide Aquatic Tissue Toxics Assessment Report (p.12).
[HYPERLINK "http://www.oregon.gov/deq/FilterDocs/wqmtissueaq.pdf"]

1. Data from the western U.S. and Canada show that Oregon's fish tissue criterion for mercury (0.04 mg/kg) is exceeded in most locations where data is available. The problem is ubiquitous across the landscape (see Figure 3-3 below).

2. Data from the Mercury Deposition Network and the scientific literature demonstrate that mercury is present in precipitation and that mercury is deposited onto Oregon waters and watersheds (commonly referred to as "atmospheric deposition") (see Figure 3-4).

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movement of mercury from the land into the water. This provides an opportunity for the state to

[9] Amos et al, 2013. Legacy impacts of all-time anthropogenic emissions on the global mercury cycle. BIOGEOCHEMICAL CYCLES, VOL. 27, 410–421, doi:10.1002/gbc.20040

[10] Oregon Department of Environmental Quality, 2019. Draft Total Maximum Daily Load for Mercury in the Willamette River Basin.

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tissue criterion for methylmercury, and thus the fish consumption use, is not attainable in the Willamette Basin during the term of the variance. There is sufficient data and information to demonstrate that mercury is a human caused condition that cannot be remedied in the Willamette Basin through the implementation of Clean Water Act requirements by NPDES permitted dischargers or the State within the timeframe of the variance. Based on the data and literature, mercury levels in the Willamette Basin result primarily from sources other than point source discharges. The majority of the mercury originates outside the basin or the State and is deposited from the atmosphere into waterways or onto the landscape either as dry deposition or contained in rainfall. These findings justify the need for a variance for the Willamette Basin, consistent with 40 CFR 131.10(g)(3).

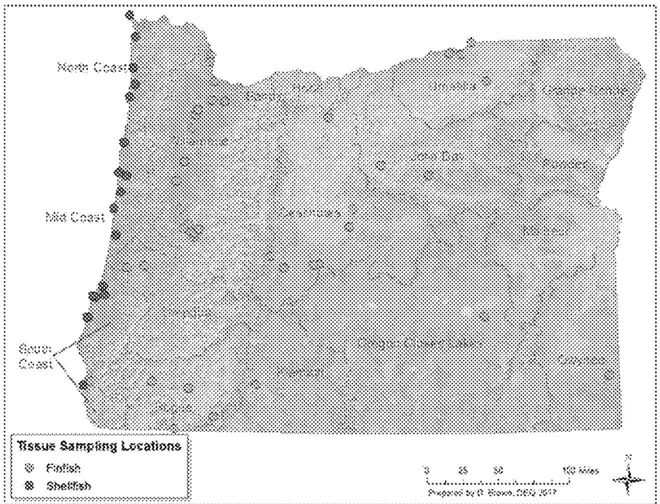

Figure [STYLEREF 1 \s]-[SEQ Figure * ARABIC \s 1]. Tissue sampling sites (2008-2015). From DEQ's Statewide Aquatic Tissue Toxics Assessment Report (ODEQ, 2017, p. 2).

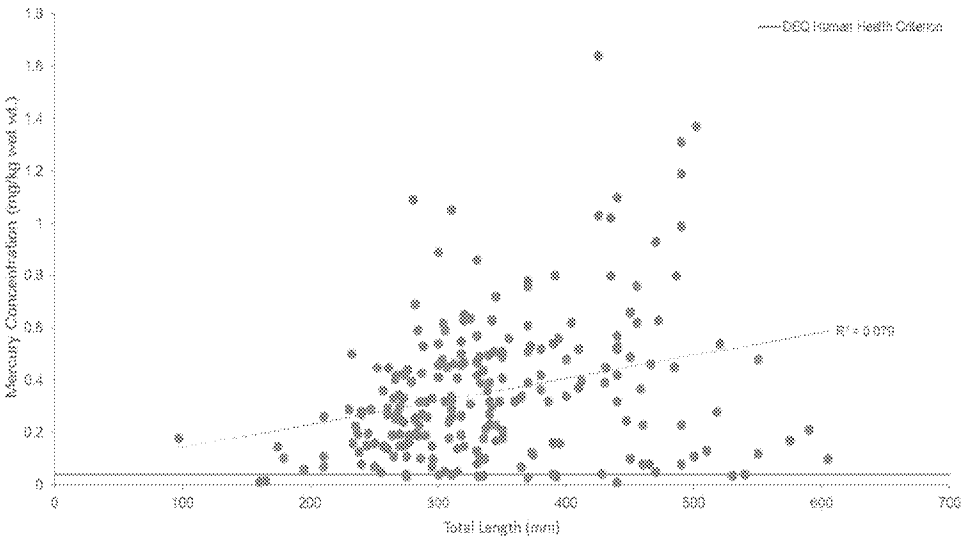

Figure [STYLEREF 1 \s]-[SEQ Figure * ARABIC \s 1]. Mercury concentration (mg/kg wet weight) in skinless finfish fillets compared to total length (mm). The orange line indicates the DEQ human health criterion for methylmercury (0.04 mg/kg fish tissue). (ODEQ, 2017, p. 13, Figure 10.)

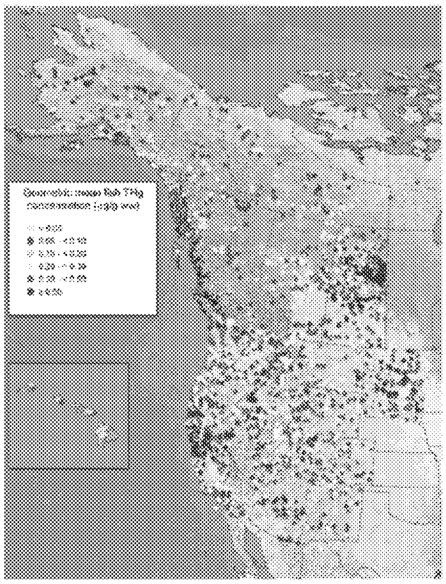

Figure [STYLEREF 1 \s]-[SEQ Figure * ARABIC \s 1]. Geometric mean of fish tissue concentrations by site. Note that µg/g is equal to mg/kg. Only locations with turquoise dots would have geometric means close to the 0.04 mg/kg standard. From Eagles-Smith et al., 2016b (Figure 9).

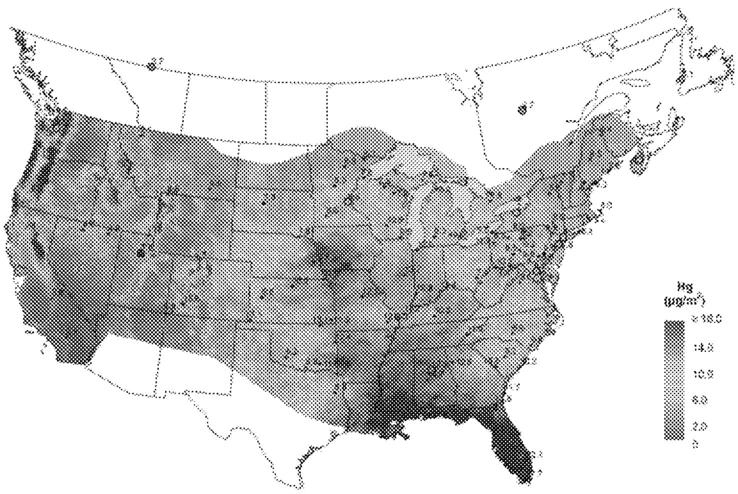

Figure [STYLEREF 1 \s]-[SEQ Figure * ARABIC \s 1]. Total Mercury Wet Deposition in 2014 (Mercury Deposition Network, 2017)

2.2 Water Quality Based Effluent Limits for mercury are not achievable

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2.2.1 Mercury Removal Achieved by Municipal Treatment Technologies

This section presents data on mercury levels achieved by municipal treatment systems in Oregon and California. In 2005, California performed a study looking at methylmercury removal from NPDES permitted dischargers in the Sacramento River Delta[11]. California required dischargers to collect and report on methylmercury influent and effluent data over twelve months in 2004 and 2005. A subset of these facilities also reported total mercury effluent data. A summary of annual average total mercury effluent concentrations is shown in Figure 3-5. The facilities were categorized as either secondary or tertiary treatment plants. The median of the average annual total mercury effluent concentrations was 7.4 ng/L in secondary treatment plants (n=27) and ranged from 3.1-21.5 ng/L. In tertiary treatment plants (n=22), the median average annual concentration was 3.3 ng/L and ranged from 0.8 – 11.6 ng/L.

DEQ also compiled and analyzed mercury levels from 2016 data provided by municipal dischargers in Oregon (Figure 3-6). In this case, DEQ categorized each system as secondary or advanced. Advanced systems included any in which additional filtration or treatment was installed after secondary treatment. The median average annual total mercury effluent concentration was 2.9 ng/L for secondary treatment plants (n=11) and ranged from 1.2 to 8.3 ng/L. In advanced treatment plants (i.e., those employing nutrient removal, tertiary or other post-secondary treatment filtration, or both) (n=8), the median annual average concentration was 1.7 ng/L and ranged from 1.1 to 3.0 ng/L. The Oregon data comes from the state's larger facilities, which have a pre-treatment program and have implemented source control programs for several to many years. The California data comes from both large and small systems, is 12 years older than the Oregon data, and comes from the Sacramento River Delta, which has high mercury levels resulting from historical gold mining. These facts may explain why Oregon effluent data has considerably lower concentrations than that from California.

[11] California EPA, Regional Water Quality Control Board, Central Valley Region. 2010. Staff Report: A Review of Methylmercury and Inorganic Mercury Discharges from NPDES Facilities in California's Central Valley.

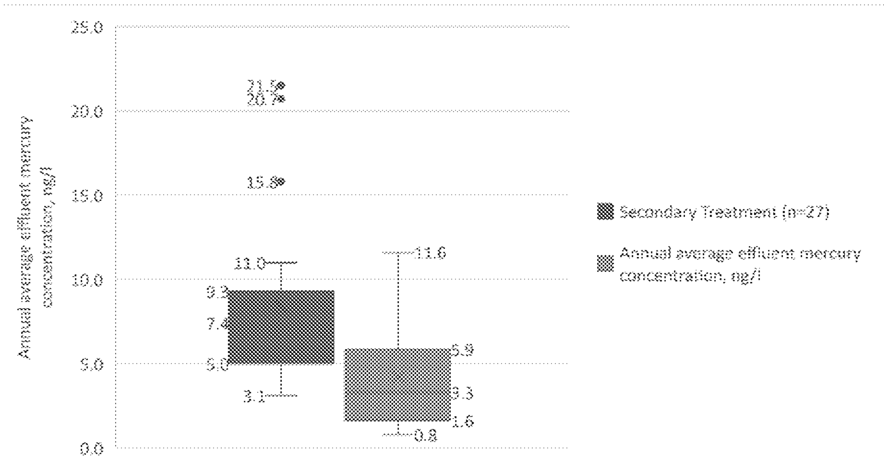

Figure [STYLEREF 1 \s]-[SEQ Figure * ARABIC \s 1]. Average Total Mercury Effluent Concentration, Sacramento Delta WWTPs, 2004-5. Source: California EPA, Regional Water Quality Control Board, Central Valley Region. 2010. Staff Report: A Review of Methylmercury and Inorganic Mercury Discharges from NPDES Facilities in California's Central Valley.

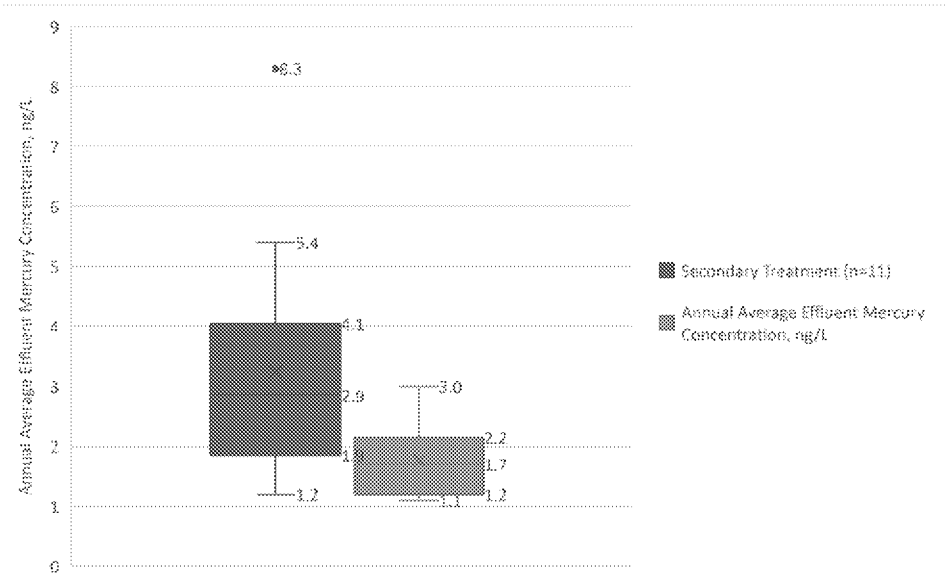

Figure [STYLEREF 1 \s]-[SEQ Figure * ARABIC \s 1]. Average Total Mercury Effluent Concentrations, Oregon pre-treatment WWTPs, 2016

Note: The Oregon wastewater treatment facilities included in the advance treatment group (n=8) for this graphic include: Rock Creek and Durham operated by Clean Water Services, McMinnville, Wilsonville, Albany, Kellogg Creek, Newberg and Tri-cities. Only a portion of the Tri-cities WWTP flow is filtered after secondary treatment; however, the average mercury concentration in effluent in 2016 was 1.6 ng/L, which is comparable to other advanced systems.

2.2.2 Review of Available Treatment Technologies

In variance applications for individual variances, Clean Water Services, which operates four wastewater treatment plants in the Willamette Basin, provided the results of a literature review on the ability of available treatment technologies to remove mercury. CWS noted that their literature review did not identify pilot or full-scale treatment systems that would be able to achieve the 2006 TMDL target of 0.92 ng/L, nor the lower water concentration target from the [redacted]

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[12] Ohio Environmental Protection Agency. 1997. Assessing the Economic Impacts of the Proposed Ohio EPA Water Rules on the Economy. Prepared for the Division of Surface Water by Foster Wheeler Environmental Corporation and DRI/McGraw Hill.
[13] Treatment Technology Review and Assessment, Association of Washington Businesses, HDR, Dec. 2013.

In addition, membrane filtration technologies have high energy costs, creating a substantial carbon footprint, and need to dispose of the removed waste sludge. According to a life cycle assessment performed for the Berlin-Ruhleben secondary wastewater treatment plant (63 MGD), the operational energy use of polymer ultrafiltration or ceramic microfiltration membranes would be 0.33 watt×hour/gal. This would represent approximately a 9 percent increase in that plant's existing global warming potential and does not include the additional global warming potential that would be contributed by infrastructure, chemicals for maintenance and any necessary coagulant, nor of the transport of waste sludge for disposal. Of the different types of membrane filtration, reverse osmosis also has the large disadvantage of necessitating disposal of the concentrate stream, which can amount to approximately 5 to 20 percent of the influent.

EPA contracted with Battelle to complete a review of current wastewater treatment technologies for mercury and to update the 1997 Ohio EPA study. Battelle's 2013 draft report found that bench scale and pilot tests resulted in a concentration of 1.3 ng/L. However, little information is available for facilities actually implementing a technology to remove mercury from their effluent. Of the five facilities actively using the technology referenced in the report, only two had been in operation for over two years and these facilities have small discharges (0.035 MGD and 1.4 MGD). Although technology is advancing, it has not yet been demonstrated that the newer technologies can be successful at the scale needed for a large WWTF, with varying influent concentrations and design flows.[14]

A 2007 EPA report regarding mercury treatment notes that there are technologies, such as precipitation, filtration or other physical/chemical treatments (see Table 3-1) that might treat mercury in addition to those typically employed by wastewater treatment plants. However, these have been employed in industrial settings where influent concentrations were an order of magnitude higher than influent concentrations at municipal wastewater treatment facilities[15]. The effluent concentrations at many of these industrial applications were similar to the influent concentrations at municipal treatment facilities. Moreover, the information provided in the EPA report did not indicate flow volumes, so it is difficult to translate these studies to typically larger municipal wastewater treatment plant volumes.

In another study, an oil refinery evaluated various treatment technologies for wastewater with low (10 ng/L) mercury levels to determine the extent to which mercury concentrations could be further reduced using conventional treatment. Bench scale tests of various adsorbent techniques showed that they could remove mercury to as low as less than 0.08 ng/L of total mercury[16]. Ultra- and micro-filtration tests also reduced mercury to less than 1 ng/L, although not as much as adsorption. However, such techniques have not been shown to work at the higher volume or

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[14] Michigan Department of Environmental Quality. 2015. Mercury Multiple Discharge Variance Document.
[15] U.S. EPA. 2007. Treatment Technologies for Mercury in Soil, Waste, and Water. Office of Superfund Remediation and Technology Innovation. Washington, DC. 133 pp.
[16] Urgun-Demirtas, M, P. Gillenwater, M. C. Negri, Y. Lin, S. Snyder, R. Doctor, L. Pierece and J. Alvarado. 2013. Achieving the Great Lakes Initiative Mercury Limits in Oil Refinery Effluent. Water Environment Research 85(1): 77-86.

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treatment or industrial wastewater treatment. None of these technologies have been demonstrated to be feasible for large municipal WWTFs and it is not known what effluent concentrations could be achievable if they were used for this purpose. Table 3-2 summarizes results from various technologies.

Table [STYLEREF 1 \s]-[SEQ Table * ARABIC \s 1]. Potential treatment technologies considered for mercury treatment

Study	Type of treatment technology	Influent total mercury concentration (ng/L)	Average effluent total mercury concentration (ng/L)	Percent removal	
EPA (2007)[18]	Precipitation (Chelator)	400-9,600,000	25-21,400	42-99.9%	Full scale for groundwater and wastewater treatment; not tested for municipal wastewater or industrial processes in Willamette Basin
EPA (2007)[6]	Adsorption/ Granular Activated Carbon	3,300-2,500,000	300-1,000	99-99.8%%	Full scale
HDR Study (2013)[19]	Tertiary Microfiltration/ Reverse Osmosis		0.12-1.2 hypothetically	>99%	Not demonstrated at WWTP scale
HDR Study (2013)	Tertiary Microfiltration/ Granular Activated Carbon		0.12-1.2 hypothetically	>99%	Not demonstrated at WWTP scale

[17] Treatment Technology Review and Assessment, Association of Washington Businesses, HDR, Dec. 2013.
[18] U.S. Environmental Protection Agency. 2007. Treatment Technologies for Mercury in Soil, Waste, and Water. Office of Superfund Remediation and Technology Innovation. Washington, DC. 133 pp.
[19] HDR. 2013. Treatment Technology Review and Assessment. Prepared for the Association of Washington Businesses.

Urgun-Demirtas, et al. (2013)[20]	Precipitation	10 ng/L	3.1 ng/L (before filtration) 0.17 ng/L (after filtration)	56.5% before filtration	Bench scale testing
Urgun-Demirtas, et al. (2013)	Adsorption	10 ng/L	<0.08 ng/L – 0.72 ng/L (lowest achieved)	92.8% - 99.2%	Bench scale testing
Urgun-Demirtas, et al. (2013)	Filtration	10 ng/L	0.26 – 0.34 ng/L (lowest achieved)	65 – 97% depending on pressure	Bench scale testing
Hollerman, et al. (1999)[21]	Adsorption	739-1447 ng/L	~25-340 ng/L	n/a	Low volume

Table [STYLEREF 1 \s]-[SEQ Table * ARABIC \s 1]. Treatment capability of mercury technologies

Treatment Technology	Volume Range of Known Uses	Treatment Ability
Activated sludge	Up to 25 MGD	3-50 ng/L
Activated sludge w/ Nutrient Removal or Filtration	Up to 25 MGD	1-10 ng/L
Membrane Filtration	Low volume	Bench scale to 0.26 ng/L
Ion Exchange	0.015 MGD (5-50 GPM)	1 ng/L
Precipitation and filtration	Low volume	Bench scale to 0.17 ng/L; full scale to 25 ng/L
Adsorption	Low volume	Bench scale to 0.08 ng/L; full scale to 25 ng/L

3. Variance Requirements

[20] Urgun-Demirtas, M, P. Gillenwater, M. C. Negri, Y. Lin, S. Snyder, R. Doctor, L. Pierece and J. Alvarado. 2013. Achieving the Great Lakes Initiative Mercury Limits in Oil Refinery Effluent. Water Environment Research 85(1): 77-86.

[21] Hollerman, W., L. Holland, D. Ila, J. Hensley, G. Southworth, T. Klasson, P. Taylor, J. Johnston, and R. Turner. 1999. Results from the low level mercury sorbent test at the Oak Ridge Y-12 Plant in Tennessee. Journal of Hazardous Materials B68:193-203.

To comply with federal regulations, a variance must include a statement of the highest attainable condition during the term of the variance, the term of the variance, and a requirement to re-evaluate the HAC at least every 5 years. Each of these is discussed below.

3.1 Highest Attainable Condition

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As described below, DEQ has determined that HAC #3 is the appropriate expression for the MDV because either: 1) additional feasible pollutant control technology does not exist, as is the case for facilities already utilizing advanced treatment, or 2) a treatment upgrade would not result in substantially lower effluent concentrations than can be achieved through a pollutant minimization program and would cause more environmental harm than source reduction.

3.1.1. Facilities with advanced treatment – Additional feasible technology does not exist that will significantly reduce mercury concentrations

For facilities with advanced wastewater treatment, there is no feasible technological upgrade that will significantly reduce mercury loads in a discharger's effluent, as demonstrated in Chapter 3. Thus, for these facilities, HAC #3 is appropriate. Based on available data provided in Section 3.2, such systems are capable of achieving annual average mercury concentrations of 1 - 3.5 ng/L. As described in Section 5, DEQ will include permit effluent limits based on the level currently achievable, using the methodology in Appendix A, and require the facility to develop and implement an MMP, including monitoring and reporting requirements.

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[22] [HYPERLINK "https://www.epa.gov/wqs-tech/water-quality-standards-variance-building-tool?utm_medium=email&utm_source=govdelivery"]
[23] 40 CFR 131.14(b)(ii)(A)

3.1.2. Facilities without advanced treatment – MMP implementation will result in effluent concentrations similar to that of advanced treatment with less environmental harm

During the twenty year term of the variance, MMP implementation at facilities without advanced treatment will result in effluent concentrations similar to that of facilities with advanced treatment and will result in less environmental harm than installing treatment upgrades. Therefore, HAC #3 will be used to establish requirements for facilities without advanced treatment. Effluent limits will be developed using the process developed described in Section 5.1.1 and MMP implementation will be required as described in Section 5.3.

As described in section 3.2.2, municipalities using advanced wastewater treatment (either tertiary filtration or nutrient removal) have mercury effluent concentrations ranging from about 1-6 ng/L as an annual average. Moreover, there are no current feasible technologies that have been demonstrated to achieve mercury effluent concentrations lower than about 1 – 3.5 ng/L.

Some secondary treatment plants have higher mercury concentrations in their effluent than advanced treatment plants. Data indicates that over the 20-year proposed term of the variance, appropriate implementation of an MMP at facilities without advanced treatment will result in similar mercury concentrations as that achieved at advanced treatment plants.

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99th percentile (1-day and 4-day P99) metrics. For our analysis, we focused on the 4-day metric as evidence of a longer term trend. Among 52 municipal dischargers, the average 4-day P99 decreased from 11.2 ng/L in the initial 5-year period that was tracked[24] to 3.2 ng/L in the most recent 5-year period (2014-2018). The median 4-day P99 during this time also decreased from 5.2 to 2.8 ng/L. All but three municipal systems experienced decreasing trends in average effluent concentrations and all but eight experienced decreasing 4-day P99 concentrations (Figure 5-1). Moreover, whereas 13 facilities had 4-day P99s greater than 8 ng/L in their initial permit term, only one facility had a 4-day P99 greater than 8 ng/L based on the most recent data (Figure 5-2), highlighting how effluent levels have decreased over time. The mercury concentrations seen at most of these facilities are within the range seen at advanced municipal wastewater treatment plants. According to WDNR staff, none of these facilities employ advanced treatment, but have achieved these levels through minimization.[25]

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[24] The initial 5 year period varied from permit to permit.
[25] *Personal communication*, Laura Dietrich, Wisconsin Department of Natural Resources, 2/28/19.

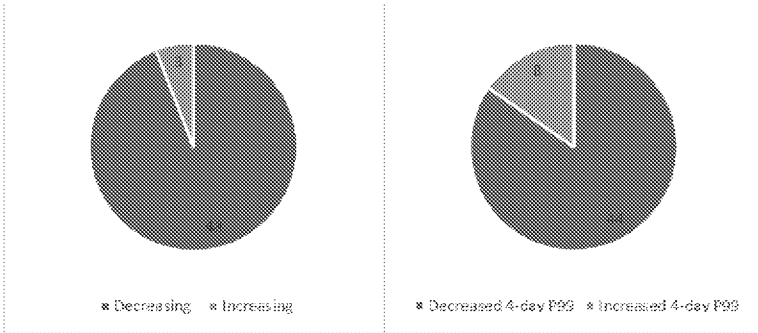

Figure [STYLEREF 1 \s]-[SEQ Figure * ARABIC \s 1]. Number of Wisconsin municipal wastewater treatment systems with increasing and decreasing trends in average (left) and 4-day P99 (right) concentrations. Source: Wisconsin Department of Natural Resources.

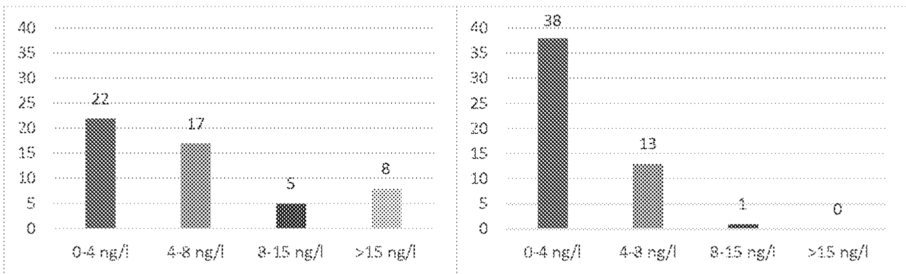

Figure [STYLEREF 1 \s]-[SEQ Figure * ARABIC \s 1]. Number of Wisconsin municipal WWTPs by 4-day P99 mercury concentrations from initial five-year period (left) to most recent five-year period (right). Source: Wisconsin Department of Natural Resources.

Available data from Wisconsin also indicates an overall decreasing trend in mercury concentrations at industrial facilities. Among 24 industrial NPDES permit holders, the mean 4-day P99 decreased from 25.4 to 13.7 ng/L and the median 4-day P99 decreased from 14.1 to 7.2 ng/L. Eighteen of the 24 facilities had lower 4-day P99 concentrations in the most recent five-year period as compared to the initial period, and sixteen had decreasing average mercury concentrations (Figure 5-3). Finally, while only one additional facility had a 4-day P99 less than

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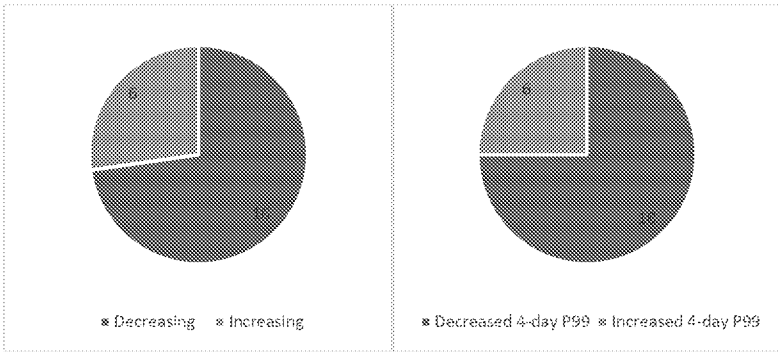

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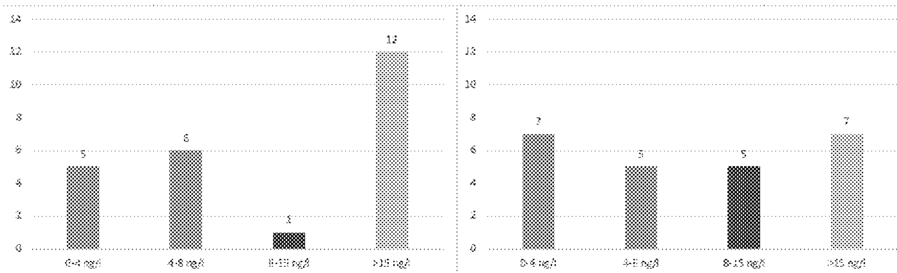

Figure [STYLEREF 1 \s]-[SEQ Figure * ARABIC \s 1]. Number of Wisconsin industrial NPDES facilities by 4-day P99 mercury concentrations from initial five-year period (left) to most recent five-year period (right). Source: Wisconsin Department of Natural Resources.

Evidence from influent and biosolids data also indicates the effectiveness of MMPs in reducing mercury, even when effluent levels are variable. A decade of mercury influent data from 72 major NPDES wastewater treatment plants in Minnesota indicate that MMPs have resulted in significant and continued reductions in mercury concentrations entering treatment systems. Between 2008 and 2017, influent total mercury concentrations decreased from an average of 180 ng/L to 70 ng/L (Figure 5-5). Data from Oregon's Rock Creek Advanced Wastewater Treatment Plant operated by Clean Water Services indicates decreasing mercury levels in biosolids, showing the effectiveness of their mercury reduction efforts over the last 20 years (Figure 5-6).

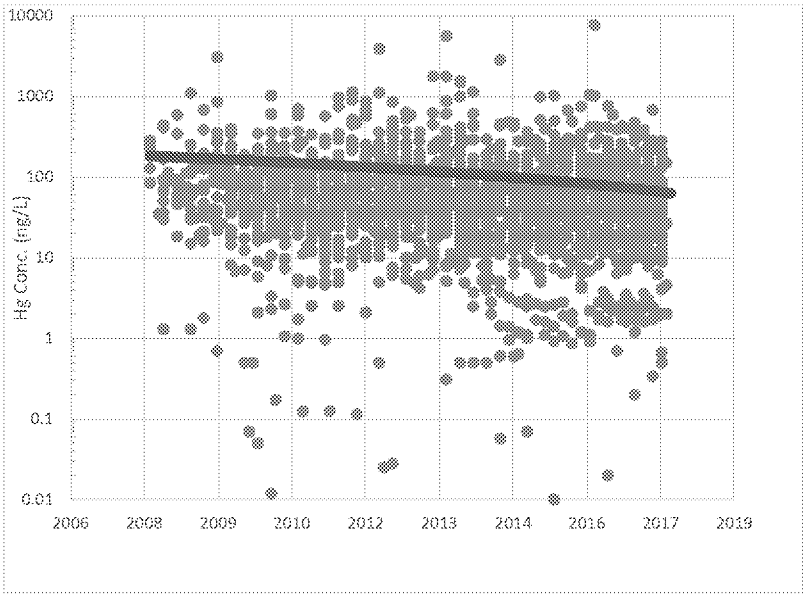

Figure [STYLEREF 1 \s]-[SEQ Figure * ARABIC \s 1]. Influent Data from Major Wastewater Treatment Plants in Minnesota. Source: Minnesota Pollution Control Agency

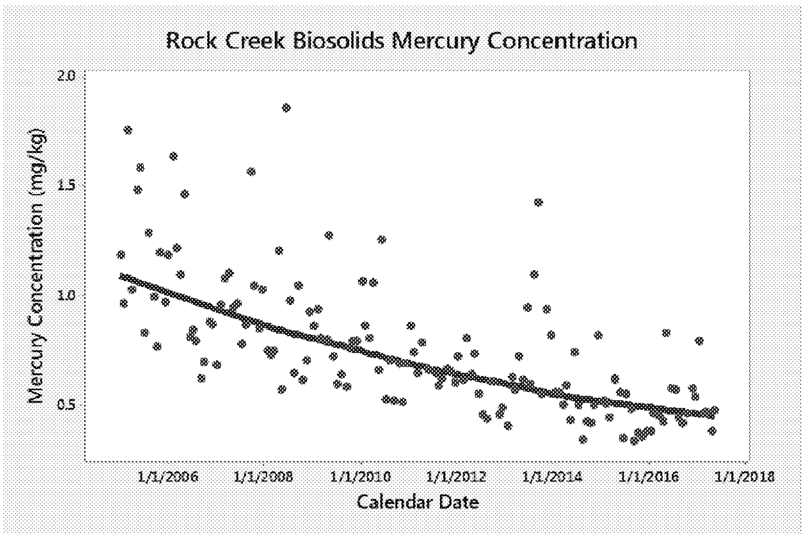

Figure [STYLEREF 1 \s]-[SEQ Figure * ARABIC \s 1]. Mercury Concentrations in Biosolids, Rock Creek Wastewater Treatment Plan. Source: Clean Water Services.

In addition to achieving similar effluent concentrations as advanced treatment, MMP implementation, incurs less environmental harm than advanced treatment. Environmental costs associated with advanced treatment include greater energy consumption, added greenhouse gas emissions, and the need for additional waste disposal.[26]

According to a report from the Water Research Foundation and Electric Power Research Institute, daily energy consumption at advanced treatment plants is about 500-600 kwh per million gallons per day higher than that of secondary activated sludge plants.[27] Thus, for the smallest facility likely to need a variance (those with approximately 1 MGD design flow), the additional annual energy consumption to upgrade to advanced treatment is 219 megawatt-hours per year. This equates to an annual carbon footprint increase of approximately 125 metric tons carbon dioxide equivalent per year.[28] According to U.S. EPA's analysis of the social costs of one metric ton of greenhouse gas emissions in 2020 dollars ranges from $12 to $123[29]. The increased energy consumption at a smaller plant covered by the variance would have a social cost ranging from $1,500 to $15,375 per year, while having a similar outcome to source reduction. For larger facilities that may receive coverage under the variance, additional treatment could equate to as much as 5000 metric tons CO_2 equivalent per year released into the environment. Additional waste disposal required by wastewater treatment would add additional carbon footprint due to the need to haul additional material. Moreover, waste disposal could result in land application of material containing mercury, which would potentially be re-released to the environment.

The total mercury load from all point sources to rivers in the Willamette Basin is 1.6 kg/year[30], or about 1% of the total annual load of mercury to the basin. Treatment upgrades at the estimated number of facilities with higher mercury concentrations would only reduce a portion of this load, which would also likely be achieved eventually through source reduction without the associated environmental cost. Therefore, DEQ has concluded that the additional energy use and waste disposal associated with advanced treatment would cause more environmental harm than removing similar amounts of mercury load through MMPs, which focus on source reduction, even though the source reduction may take more time to achieve the comparable effluent levels.

3.2.3. Facilities that are planning upgrades that reduce mercury levels

In some cases, a facility may upgrade its treatment system and reduce a variety of pollutants in the discharge, including mercury. For these facilities, HAC #3 is still appropriate; however, permit conditions will change once the facility upgrades its treatment system. Until the upgrade

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[26] DEQ acknowledges that treatment upgrades are sometimes necessary for reasons other than mercury removal. This possibility is incorporated into the procedure for Highest Attainable Condition described in Chapter 6.
[27] Electric Power Research Institute and Water Research Foundation. 2013. Electricity Use and Management in the Municipal Water Supply and Wastewater Industries. 194 pp.
[28] To calculate the annual carbon footprint, DEQ utilized carbon footprint information utilized in the 2019 Triple Bottom Line analysis to support the chloride and mercury variance for the city of Madison, Wisconsin.
[29] [HYPERLINK "https://19january2017snapshot.epa.gov/climatechange/social-cost-carbon_.html"]
[30] Oregon Department of Environmental Quality. 2019. Draft Willamette River Total Maximum Daily Load for Mercury.

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3.2 Requirements that apply throughout the term of the variance

This section describes the requirements of the variance, consistent with HAC #3. First, the discharger will receive a permit limit based on the "level currently achievable." Second, the discharger will be required to develop and implement a mercury minimization plan. The requirement and the procedures for establishing the specific HAC's for each discharger are discussed in this section. The HAC must be re-evaluated every 5 years, as discussed in section 3.4.

3.2.1 Level Currently Achievable

The HAC for the MDV is expressed in the federal variance rule as "the interim criterion or interim effluent condition that reflects the greatest pollutant reduction achievable with the pollutant control technologies installed at the time the State adopts the WQS variance, and the adoption and implementation of a Pollutant Minimization Program." DEQ uses the term "Level Currently Achievable" to describe "the interim effluent condition that reflects the greatest pollutant reduction achievable with the pollutant control technologies installed at the time the State adopts the WQS variance."

In order to calculate the LCA for mercury for each facility, DEQ will use the most recent five years of mercury effluent data at the time of each permit issuance, with a minimum of eight quarterly samples that span at least two years. Each sample is a single data point, even when the facility collects samples on three consecutive days, as required by the pretreatment program. The [HYPERLINK "https://www3.epa.gov/npdes/pubs/owm0264.pdf"] (Table E-1), with lognormal transformation and no auto-correlation, is used to calculate the 95th percentile of the effluent data distribution to describe the Level Currently Achievable. DEQ used data from four facilities to demonstrate how DEQ would calculate these levels (Figures 3-7 – 3-10). The LCA value is equal to the 95th percentile of the distribution shown in each chart. The figures also include the 99th percentile value for information only.

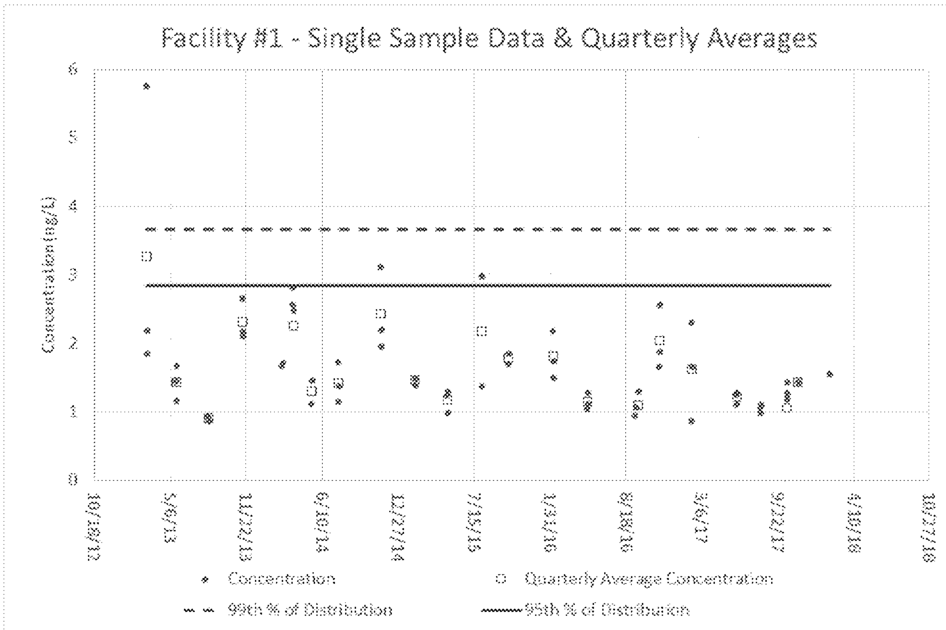

Figure [STYLEREF 1 \s]-[SEQ Figure * ARABIC \s 1]. LCA (95th percentile) of hypothetical facility under the MDV. 99th percentile value shown for informational purposes.

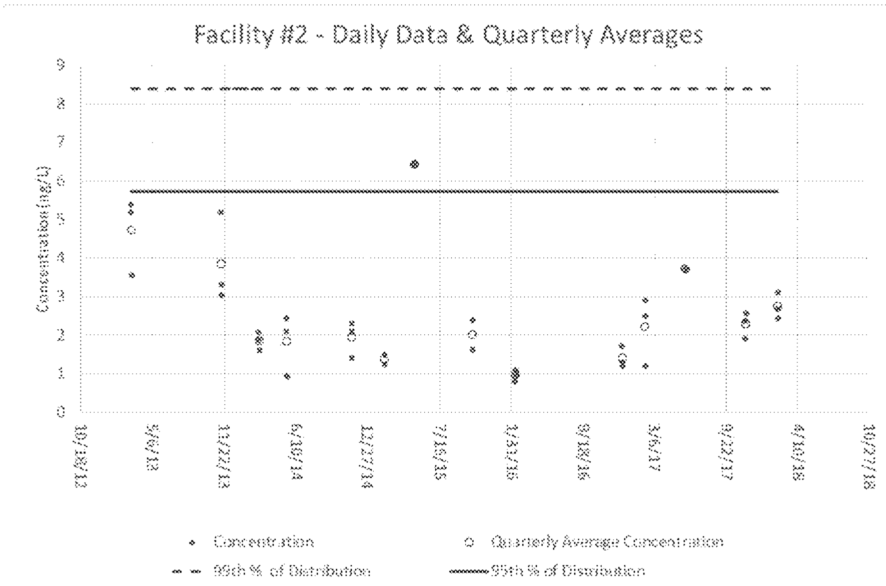

Figure [STYLEREF 1 \s]-[SEQ Figure * ARABIC \s 1]. LCA (95th percentile) of hypothetical facility under the MDV. 99th percentile value shown for informational purposes.

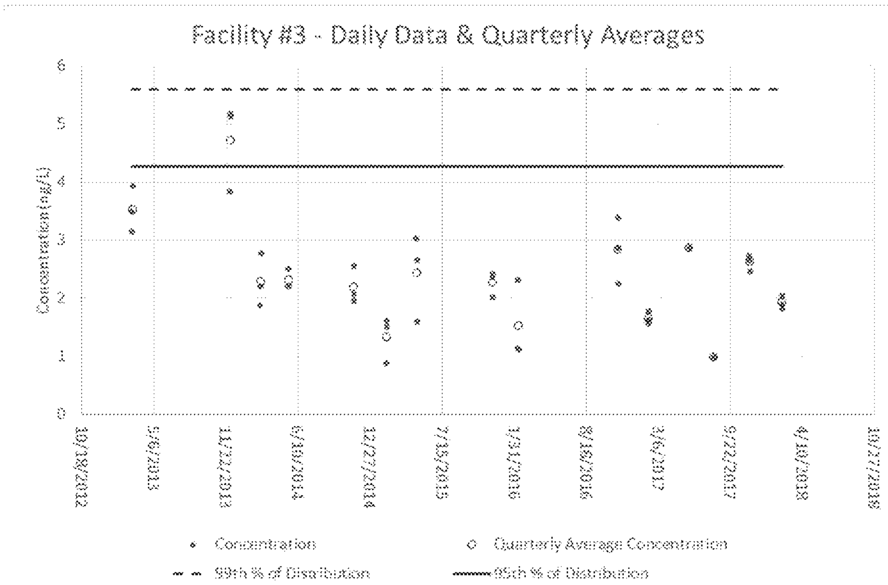

Figure [STYLEREF 1 \s]-[SEQ Figure * ARABIC \s 1]. LCA (95th percentile) of hypothetical facility under the MDV. 99th percentile value shown for informational purposes.

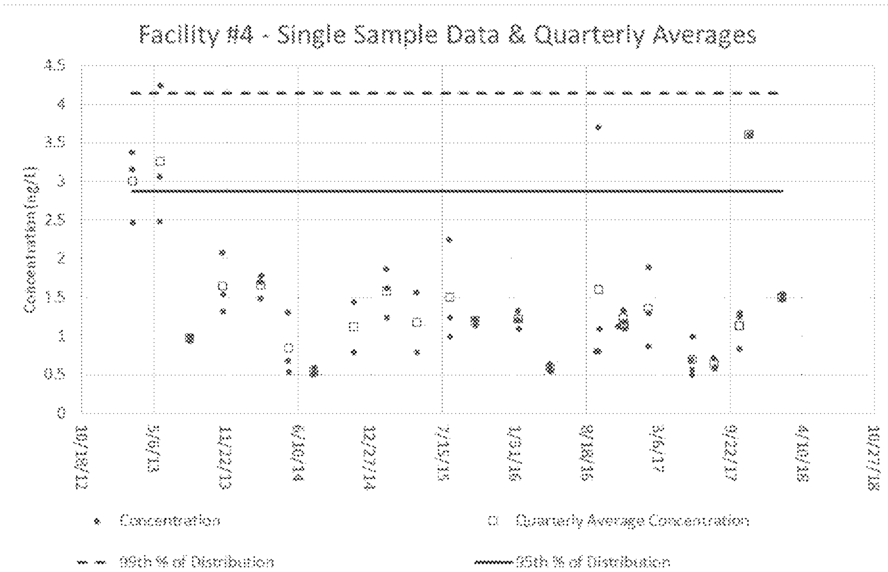

Figure [STYLEREF 1 \s]-[SEQ Figure * ARABIC \s 1]. LCA (95th percentile) of hypothetical facility under the

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For municipal wastewater treatment plants, reduction efforts should address potential mercury sources from dental offices, medical facilities, schools and other laboratories. DEQ acknowledges that, statewide, dental offices already are required to install mercury amalgam collectors, but cities may want to have an outreach program to ensure the requirements are being

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[31] Oregon Department of Environmental Quality, 2010. Internal Management Directive: Implementation of Methylmercury Criterion in NPDES Permits. DEQ12-WQ-0011-IMD. Available at: [HYPERLINK "https://www.oregon.gov/deq/Filtered%20Library/IMDmethylmercuryCriterion.pdf"]

followed and maintained. Municipalities should include some process for periodically identifying potential mercury sources outside of these areas, such as manufacturing facilities that may be in the facility's collection system that may have mercury sources. DEQ also acknowledges that different municipalities are in different stages of MMP implementation. Therefore, a municipality developing its first MMP may focus its efforts on developing an inventory of potential mercury sources, such as those from dental, medical and educational facilities; public education and outreach; and contacts with dental offices and other organizations in its inventory. A municipal facility that has been implementing an MMP for ten years or more may focus on finding lesser known sources and maintaining its current outreach efforts.

For industrial facilities, the draft rule recommends that MMP activities address mercury-containing materials used in a facility's manufacturing process and/or testing laboratories, as well as a process for identifying other potential mercury sources.

For all facilities, the MMP should describe any monitoring that will be conducted, including compliance monitoring under the permit.

3.3 Proposed term of the variance

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3.4 Re-evaluation of the Highest Attainable Condition

[32] 40 CFR 131.14(b)(1)(iv)

Federal rules require that DEQ re-evaluate the HAC at least every five years. The HAC re-evaluation process provides the permittee the opportunity to document the success of mercury minimization efforts and update its MMP. Re-evaluation also provides DEQ the opportunity to determine if source reduction efforts have resulted in progress toward meeting the water quality standard.

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4. Variance Application and Issuance Process

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4.1 Application Process for Coverage under the MDV

Once the MDV is approved by EPA, eligible NPDES dischargers in the Willamette basin can apply to be permitted under the variance concurrent with applying for permit renewal. Permitting facilities under the MDV will be more efficient for both DEQ staff and for the permittee than if each discharger had to apply for an individual variance.

Each permittee shall provide the following information:

- Information about the facility's treatment system, including their current treatment technology, the location of their discharge outfall, and their pretreatment program, if applicable.
- The most recent mercury effluent data (as much as available for the last 5 years, but not less than two years).
- Other available mercury data from the previous five years, including influent data, biosolids data, and any other data collected to track mercury sources. Such data will assist DEQ in supporting its decision to justify the variance application and its ability to do the 5 year HAC reviews.
- A description of prior mercury minimization efforts to date. This could include copies of

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4.2.1 Effluent limit based on the Level Currently Achievable

DEQ will include an interim effluent limit in each permit based on the LCA procedure described in Section 3.2.1. These permit limits will apply as a quarterly average concentration, not to be exceeded in 2 consecutive quarters.

Because many facilities sample mercury just once per quarter, a spike in mercury concentrations could cause an exceedance of the quarterly average, while not being indicative of a problem in treatment operations. Therefore, it is not appropriate to set a permit limit based upon the sampling results for a single quarter. Instead, DEQ proposes to define a violation of the maximum quarterly average permit limit as two consecutive quarters in which the quarterly average is above the 95th percentile of the distribution. Thus, one quarterly average above the 95th percentile is not a permit violation. However, if the quarterly average is above the 95th percentile again in the following sampling period, then the limit has been exceeded.

Most facilities that sample for mercury do so as part of their pretreatment programs. This sampling is typically conducted on three consecutive days, once per quarter. DEQ does not propose additional sampling. However, DEQ allows additional samples. If additional samples are collected, the results must be included when calculating the quarterly average.

4.2.2 Monitoring requirements

DEQ will incorporate effluent monitoring requirements into the permit to ensure compliance with the LCA-based interim effluent limit. DEQ will require a minimum of quarterly mercury effluent monitoring for each facility. Many facilities already collect at least this much mercury effluent data under pre-treatment programs or current permit requirements.

4.2.3 Implementation of a Mercury Minimization Plan

DEQ will include a requirement in the permit to implement the MMP as described in Section 3.2.2. The MMP must include mercury reductions activities throughout the 20-year term of the variance. DEQ understands that it will be difficult to provide as much specificity to activities more than five years in the future. Therefore, the discharger should provide greater detail about activities that will be completed within the permit term and describe future activities more generally. During re-evaluation of the variance for the next permit cycle, DEQ would then ask the facility to update the MMP to provide more specificity of minimization activities for that permit cycle.

4.2.4 Annual progress reports

The permit will require an annual progress report. The progress report should include, at a minimum, the following information:

- All effluent, influent, biosolids and other mercury data collected over the course of each year of the permit cycle;
- A summary of activities conducted under the MMP; and
- Any nonpoint source best management practices implemented under the authority of the permittee to address mercury loads.

4.2.5 Requirements for facilities with increasing mercury effluent concentrations

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4.2.6 Re-evaluation of requirements during permit renewal

When each permit is renewed, DEQ will re-calculate the LCA based on effluent data collected during the previous five years and incorporate that information into the permit fact sheet. DEQ then will establish an updated interim effluent limit based on the more recent data, as described in Section 4.2.1. Moreover, DEQ will require each facility to update their MMP to provide more specificity to activities that will be conducted for the duration of the permit, as well as in future permit terms, if warranted. The public will have the opportunity to provide comment on the updated MMP and permit requirements during the permit renewal process.

5. Bibliography

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